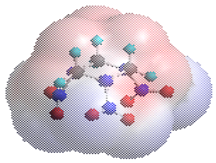
US Army Corps of Engineers®
Engineer Research and Development Center

Microbial Degradation of Explosives and Energetics

Description

ERDC's Environmental Laboratory provides customers within the Corps of Engineers and other agencies with expertise in using biological means to treat explosive contaminants. EL staff identifies mechanisms that are capable of degrading explosive contaminants using biological means. This results in low-cost, passive remediation techniques.

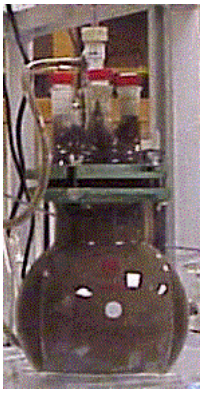


Capabilities

An interdisciplinary team comprised of an ERDC theoretical chemist, biogeochemist, microbial ecologist, microbial geneticist, plant physiologists, environmental chemist, and environmental engineers collaborate to identify and characterize microbially mediated explosive degradation processes. These processes are then incorporated into remediation systems that are biologically based.

Supporting Technology

ERDC scientists and engineers use computational chemistry to predict what the most probable environmental degradation mechanisms and transformation products will be for traditional and newly developed explosives. Explosive degradation in environmental matrices is identified and quantified by using radioactive and stable isotope tracers. The microbes that actuate the degradation are isolated and characterized with respect to physiology, biochemistry, and genetics. Working with environmental engineers, the information, microbes, and molecular reagents gained from this work are used to develop bioremediation systems.



Benefits

Most explosive molecules bare little resemblance to natural products. Those that are most foreign tend to persist in the environment. Identification of reaction mechanisms that effectively degrade and mineralize explosive contaminants is the first step in developing sustainable remediation technologies. These biodegradation processes have been engineered into traditional bioreactors and are now being engineered into landscape elements (e.g., subsurface semi-permeable barriers, treatment wetlands, and terrestrial plant communities) that can effect low-cost, passive remediation.

Success Stories

- ERDC has developed and field-tested treatment wetlands (at Volunteer Army Ammunition Plant) that effectively remediated explosives in red-water effluents. The technique developed has subsequently been used to engineer treatment wetlands at Burlington, IA.
- Soil bioslurry systems have been demonstrated at Joliet Army Ammunition Plant.

- ERDC has evaluated various means of engineering semi-permeable barriers for *in situ* groundwater remediation.

- ERDC has isolated and characterized soil bacteria that use RDX, CL-20 , and emerging cyclic nitramine explosives as sole carbon and/or nitrogen sources for their growth.

Point of Contact

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